Mechanics of woven tensile fibrous networks

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Abstract

Woven fibers are ubiquitous in a wide range of applications ranging from clothing to composites for aerospace industry or artificial biological tissues. They generally resist tension along weft and warp directions stretch along the bias direction and bend under compression. We are interested in the mechanical properties of tennis racket heads. Professional tennis players learn by experience the major role of tensions along the strings, friction between strings or with the ball or viscoelastic properties of the strings. What is the relative impact of these different parameters? We propose to analyze individual ingredients through model experiments from the scale of a string to model rackets where tension and frictional properties to the strings can be quantitatively monitored. In particular we show the strong interplay between string mechanics and geometry on the deformation of a racket head subjected to a load. Our final goal would be to provide quantitative tools to obtain the "perfect" stringing suited for individual player style.

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